

## STUDY OF THE ROLE OF MEAN PLATELET VOLUME IN PREDICTING ABORTION

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### ABSTRACT

**Background:** The termination of pregnancy by abortion in the first trimester of pregnancy and after the patient's suffering with the threat of abortion poses a social, psychological and economic dilemma, with the absence of a specific factor of high sensitivity and specificity useful in predicting when the threat of abortion occurs. **Aim:** Determination of the true value of the MPV titer as a cheap and available prognostic factor for predicting pregnancy outcome in patients with threatened abortion in the early stage of pregnancy. **Materials and METHODS:** This study is a prospective case-control study. The study included pregnant women attending the Department of Obstetrics and Gynecology Tishreen University Hospital TUH in Lattakia. In the period from the beginning of March 2022 until the end of February 2023 for those who have met the criteria for admission. The women in the study sample were divided into two groups as follows: 1. The first group included 45 women - The group of cases: it is a group of women who have the threatened abortion and who fulfill the conditions of admission and exclusion. 2. The second group included 35 women - The control group: a group of pregnant women with a normal pregnancy who went to hospital for the purpose of routine monitoring. **Results:** There were no statistically significant differences between the two groups in terms of age of the pregnant woman, gestational age, number of pregnancies, and number of abortions. The average number of platelets in the abortion group was higher than that of the control group, and it was higher in the event of a abortion compared to when it did not occur, but by statistical analysis the differences were not significant, which is consistent with slight changes in the number of platelets during the development of pregnancy. MPV and PDW were significantly higher ( $P < 0.05$ ) in the abortion threat group compared to normal pregnancy, and higher in women who developed a abortion compared to those who did not, The mean values of MPV in the abortion group were  $10.4 \pm 1.6$  and in the normal pregnancy group  $8.02 \pm 0.8$  with  $p$ -value = 0.001, while the mean values of PDW were  $15.33 \pm 1.1$  in the abortion group and  $13.6 \pm 1.2$  in the normal pregnancy group with  $p$ -value = 0.02. **Conclusions:** The rise in mean platelet volume can be used as a predictor of the risk of abortion. The value 10.2 achieves the best fit among the predictive values and is suggested as a cut-off value for predicting abortion.

**KEYWORDS:** spotanous abortion, platelet count, Mean platelet volume MPV, Platelet distribution width PDW.

### INTRODUCTION

The termination of pregnancy by abortion in the first trimester of pregnancy poses a patient's suffering with the threat of abortion a social, psychological and economic dilemma, with the absence of a specific factor of high sensitivity and specificity useful in predicting the occurrence of a threat of abortion.

Threatened abortion occurs in 20-40% of pregnant women, and is associated with a 10-14% risk of total abortion (Basama FM et al., 2004).

The pathogenesis of threatened abortion is due to hemorrhage from the uteroplacental vessels at the edge of the placenta with accumulation of blood between the chorionic membrane and the uterine wall (Jauniaux E et al., 2003). If the subchorionic hematoma expands to the rest of the placenta, it will induce complete abortion within a week of the first symptoms. If the bleeding is limited, the pregnancy may continue.

Platelets have a key role in haemostasis. It has been indicated that platelet size reflects platelet activity and is measured using mean platelet volume (MPV). Large

platelets are more reactive and produce more prothrombotic factors. (Bath PM *et al.*, 2009).

In normal pregnancy, there is an increase in platelet aggregation, which is compensated for by an increased artefact and an increase in platelet volume. Changes in platelet size have been found to be more sensitive than changes in platelet number (Dundar O *et al.*, 2012).

Predicting pregnancy outcome in patients with threatened abortion is a practical and clinical necessity to guide treatment and prevention plans and regimens. Accordingly, several factors were proposed as potential predictors of pregnancy outcome in patients with threatened abortion, such as age, smoking, levels of some hormones, and the presence of retroplacental hematoma, but none of them had an ideal value. for clinical approval (Basama FM *et al.*, 2004).

The aim of this study is to examine whether any MPV changes detectable by simple complete blood count (CBC) precede abortion development and to consider the diagnostic value of this marker in clinical practice for the prediction of abortion.

## MATERIAL AND METHODS

The study DESIGN: a prospective case-control study.  
Place of study: Tishreen University Hospital in Lattakia Governorate  
Study period: from the beginning of March 2022 until the end of March 2023. All subjects provided written informed consents to participate in the study.

**Study sample:** The study included pregnant women in the Department of Obstetrics and Gynecology at Tishreen University Hospital TUH in Lattakia. From the beginning of March 2022 to the end of March 2023, for those who meet the admission criteria. The 80 women in the study sample were divided into two groups as follows:

The first group included 45 women - Cases group: A group of women at risk of abortion who meet the conditions of acceptance and exclusion.

The second group included 35 women - the control group: a group of pregnant women with normal pregnancies who went to the hospital for the purpose of routine monitoring.

### Inclusion criteria

- Gestational age (6-12 gestational weeks) calculated according to the last reliable regular menstrual cycle with echo confirmation.
- Pregnancy is single, and confirmation of cardiac activity in the fetus.
- For the status group: confirm the drop threat status by definition.
- For the control group: women with a normal pregnancy.

### Exclusion criteria

- Known congenital or acquired uterine anomalies.
  - The woman has a chronic or immune disease or a blood disease (previously diagnosed.)
  - The presence of a previous history of thrombosis in the woman.
- Multiple pregnancy.
- Take anticoagulant medication

### Stages of study

The research topic must first be explained and the patient's questions answered and her informed consent obtained. .

This is after adjusting her achievement of the entry criteria into the study

### The patients were divided into two groups

The first group: includes women who have threatened abortion and have fulfilled the study conditions.

The second group: is described as having uncomplicated pregnancies.

Threatened miscarriage is described as uterine bleeding in the presence of a closed cervix and sonographic visualization of an intrauterine pregnancy with detectable fetal cardiac activity.

Recording data related to each woman. Ultrasonography  
Performing a complete enumeration: drawing a venous blood sample from all patients into a tube containing 0.04 ml of 7.5% potassium salt of EDTA (Ethylene diamine tetra acetic acid) and calibration within half an hour of sample collection, using laboratory analysis devices available in the laboratory section of the hospital. Samples are taken from patients with threatening abortion during the period of uterine bleeding  
Record the results of each of the platelet count, MPV, and PDW

The woman is treated by clinic doctors without interference by the researcher in the management plan and without informing the attending physician of the results of the blood analysis.

Follow-up of women until they reach a gestational age of 20 weeks, or a abortion occurs before that.

Tab the results computerally, analyze them, and extract the results that will appear in the form of the arithmetic mean  $\pm$  the standard deviation, and the percentage, with the variable considered statistically significant when the value of the significance level  $P < 0.05$  according to the conducted test.

### Ethical considerations

Informed consent was obtained from the patients in the study, with an undertaking to keep the patient's personal information confidential. The actions taken during the study are also harmless.

### The distribution of the study sample

The research sample included 80 pregnant women attending the Department of Obstetrics and Gynecology at Tishreen University Hospital in Lattakia during the

time period 2022-2023, fulfilling the inclusion criteria in the research.

The research sample was divided into two groups: the case group, which consisted of women who visited the clinic before the 20th week, and that pregnancy ended in abortion, and the control group that followed the pregnancy until live birth.

The ages of the women ranged from 18 to 35 years, and the average age was  $28.23 \pm 3.2$  years.

#### Data analysis

This study is a randomized clinical trial. Statistical analysis was done using IBM SPSS statistics (version 20). Descriptive statistics: Quantitative variables with measures of central tendency and measures of dispersion. Qualitative variables with frequencies and percentages. The following tests were used to study the relationship between the two research groups: Independent T Student test to compare the mean of two independent groups. Chi-Square or Fisher exact test to study the relationship between qualitative variables. The results are statistically significant with a p-value  $>0.05$ . Adopting the program (IBM SPSS statistics Version 20) to calculate statistical coefficients and analyse RESULT'

#### RESULT

This study included 80 pregnant women, 45 women with a threatened abortion, and fulfilling the conditions for inclusion in the study. 35 women with a healthy pregnancy were a control group.

The two groups were similar in median age, median gestational age, median gravida, previous miscarriage histories.

In the threatened miscarriage group, 8 patients had complete spontaneous abortion during pregnancy. In analysis of the TM with ongoing pregnancy and with complete spontaneous abortion, the median MPVs were

9.2 and 12.7 fl, respectively. There was no significant difference between groups.

The mean platelet count in the threatened abortion group was higher than that of the control group, and it was higher in the case of complete spontaneous abortion than in the threatened abortion group with ongoing pregnancy, but in statistical analysis the differences were not significant, which is consistent with small changes in platelet count during the progression of pregnancy.

The arithmetic mean of the MPV and PDW values was significantly higher ( $P < 0.05$ ) in the threatened abortion group compared to control group, and higher in patients who underwent complete spontaneous abortion, and those who threatened miscarriage and ongoing pregnancy.

The arithmetic mean of the MPV values is significantly higher in the projection threatened abortion and when calculating the predictive ability according to the ROC, the area under the curve was 0.93, which gives a large predictive value, and the MPV value of 10.2 femtoliters achieved the best fit between the predictive values with a sensitivity of 90% and a specificity of 84%, and it is suggested as a limiting value for predicting the projection.

The arithmetic mean of the PDW values was significantly higher in the projection threat group, and when calculating the predictive ability according to the ROC, the area under the curve was 0.92, which gives a large predictive value, and the PDW values amounted to 16.9 femtoliters, achieving the best fit between the predictive values with a sensitivity of 87% and specificity of 80%, and it is suggested as a limiting value for predicting the projection.

**Table (1): The distribution of a sample of 80 women, according to the presence of a threatened abortion, Department of Obstetrics and Gynecology at Tishreen University Hospital in Lattakia during the period 2022-2023.**

study population	number	Ratio
threatened abortion	45	56.2%
control	35	43.8%
total	80	100%

**Table (2): Distribution differences between the two research groups according to age groups.**

study population	Mean $\pm$ SD	Range	P- value
threatened abortion	26.3 $\pm$ 2.9	18 – 33	0.8
control	27.5 $\pm$ 3.1	19 - 35	

Table (3): Differences in the mean values of gestational age between the two research groups.

study population	Mean $\pm$ SD	Range	P- value
threatened abortion	8.53 $\pm$ 1.2	6 – 12	0.4
contorl	8.91 $\pm$ 1.1	6 - 12	

Table (4): the differences between the mean values of the number of pregnancies between the two research groups.

	threatened abortion	contorl	P- value
Gravidity Mean $\pm$ SD	1.85 $\pm$ 0.7	1.83 $\pm$ 0.8	0.1
pervious abortion Mean $\pm$ SD	1.8 $\pm$ 0.6	1.4 $\pm$ 0.5	0.2

Table (5): the differences between the mean values of PLT between the two research groups.

study population	Mean $\pm$ SD	Range	P- value
threatened abortion	265.6 $\pm$ 45.4	128 – 335	0.06
contorl	249.3 $\pm$ 42.2	105 - 308	

Table (6) the differences between the mean values of MPV between the two research groups.

study population	Mean $\pm$ SD	Range	P- value
threatened abortion	10.4 $\pm$ 1.6	7.9 – 13.8	0.001
contorl	8.02 $\pm$ 0.8	7.1 – 9.8	

Table (7) the differences between the mean values of PDW between the two research groups.

study population	Mean $\pm$ SD	Range	P- value
threatened abortion	15.33 $\pm$ 1.1	12.8 – 17.5	0.02
contorl	13.6 $\pm$ 1.2	12.1 – 16.1	

Table (8) the results of the survey on the incidence of abortion between the two groups of research.

study population	threatened abortion	contorl
total samples 80	45 (56.20%)	35(43.80)
Ongoing pregnancy	37(82.2%)	35(100%)
abortion	8(17.8%)	0(0%)

Table (9) Comparison of the MPV and other haematological parameters in patients with threatened abortion and ongoing pregnancy, and those who underwent complete spontaneous abortion.

Platelet indices	TM with complete spontaneous abortion	TM with ongoing pregnancy	P-value
PLT	271.9 $\pm$ 58.3	260.2 $\pm$ 37.3	0.09
MPV	12.61 $\pm$ 0.7	9.32 $\pm$ 0.5	0.001
PDW	17.28 $\pm$ 0.5	15.19 $\pm$ 0.4	0.0001

## Survey results on a cut-off value for the MPV in cases of threatened forfeiture

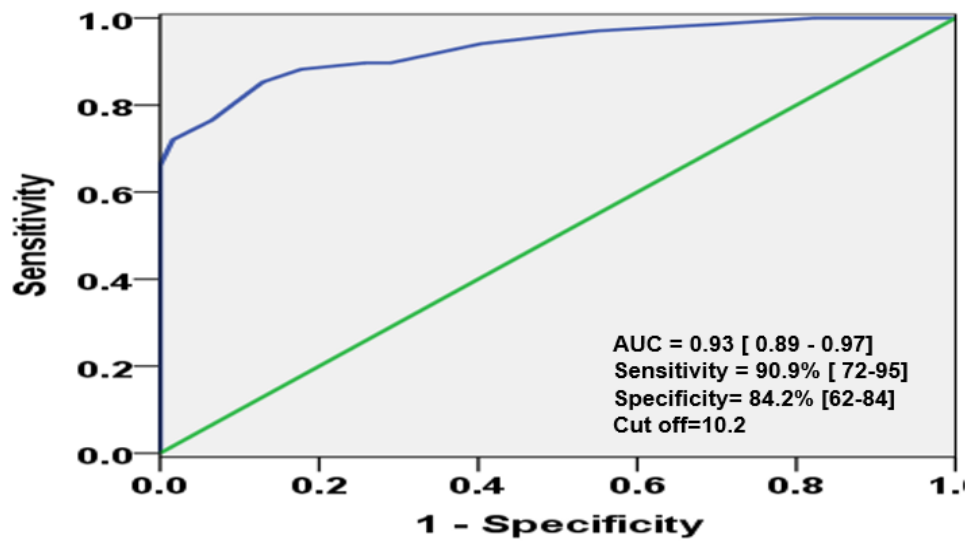


Figure (1) A schematic representation of the ROC curve of the MPV in predicting the occurrence of a abortion in cases of threatened abortion.

## Survey results on a cut-off value for the PDW in cases of threatened abortion

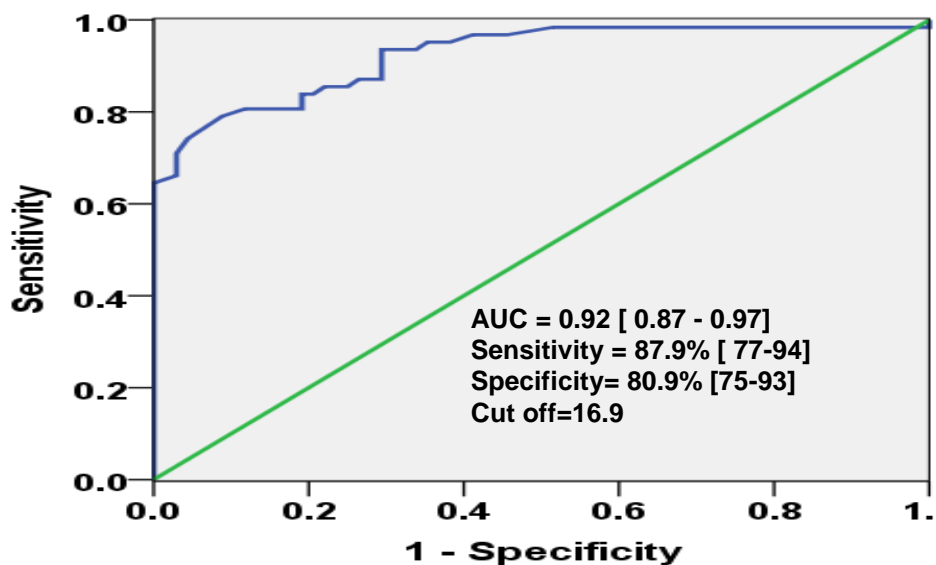


Figure (2) A chart representing the ROC curve of the PDW in predicting the occurrence of abortion in cases of threatened abortion.

## DISCUSSION

The threatened abortion poses a diagnostic and therapeutic dilemma for both the doctor and the patient, and the accompanying social and psychological problems. In addition to the material costs of the described measures. The most important problem is identifying women whose threatened abortion will progress to pregnancy loss, in the absence of a specific and reliable predictive formula.

Ultrasonography and serum assays for B-HCG and progesterone have been widely used to assess the risk of abortion in the early stages of pregnancy. However, they are not considered tests with convincing sensitivity, and given that the thrombotic and immunological status are

among the most important interfering factors in the development of this condition, the trend was towards the role of platelet function tests.

This study included 80 pregnant women, 45 women with a threat of abortion, and fulfilling the conditions for inclusion in the study. 35 women with a healthy pregnancy were a control group.

The two groups were similar in terms of the age of the pregnant woman, the average gestational age at entry into the study, and the obstetric antecedents.

pregnancies with TM, the increase of MPV levels might represent physiologic increase of bleeding from the placental bed

The mean platelet count in the abortion group was higher than that of the control group, and it was higher in the case of abortion than in the absence of it, but in statistical analysis the differences were not significant, which is consistent with small changes in platelet count during the progression of pregnancy. And with another previous study that did not record significant differences in the number of platelets between abortion patients and control patients (Eroglu M *et al.*, 2013), while the study of Aynioglu and his colleagues (2014) found that the platelet count was higher in the group of frequent abortions compared to the control group, it may be due. This difference indicates that platelet count changes are not early in the case of minor thrombotic changes and appear later.

The arithmetic mean of the MPV and PDW values was significantly higher ( $P < 0.05$ ) in the abortion threat group compared to normal pregnancy, and higher in women who developed a abortion compared to those who did not.

#### Which is consistent with previous studies

(Aynioglu O *et al.*, 2014; Mete Ural U *et al.*, 2014; Kosus N *et al.*, 2011),

#### While other studies did not record the significance of these differences.

(Eroglu M *et al.*, 2013; Akdemir N *et al.*, 2013).

The MPV value of 10.2 femtoliters achieves the best fit between the predictive values with a sensitivity of 90% and a specificity of 84% and is suggested as a cut-off value for predicting the projection.

The pathogenesis of threatened abortion is due to hemorrhage from the uteroplacental vessels at the edge of the placenta with accumulation of blood between the chorioallantoic membrane and the uterine wall (Jauniaux E *et al.*, 2003).

Platelets have a central role in clotting, and platelet size reflects their activity and is measured by mean platelet volume (MPV) (Bath PM *et al.*, 2009).

In normal pregnancy, there is an increase in platelet aggregation, which is compensated for by an increased artefact and an increase in platelet volume. Changes in platelet size have been found to be more sensitive than changes in platelet number (Dundar O *et al.*, 2012.)

Exaggerated activation of platelets at the maternal-fetal interface can provoke inflammatory activation in placental trophoblasts, and promote the formation of platelet agglomerates, leading to aseptic inflammation of the placenta and a systemic inflammatory response in the mother. Hence, the degree of activation determines whether maternal platelets are friend or foe to the human placenta. Excessive maternal platelet activation can directly cause or disseminate the disease process in placental-related pathologies of pregnancy, such as preeclampsia.

Kosus *et al.* (2011) found that the MPV is an indicator of thrombotic status when the abortion occurs.

Eroglu *et al.* (2013) reported that the MPV value is not a diagnostic test for unsuccessful pregnancies with threatened or forgotten abortions.

These results suggest that platelet function tests by complete blood count can be useful in determining the degree of blood clotting disorder, which is directly related to gestational output, which opens the way for future prospects for introducing these assays into clinical practice, and conducting deeper and more comprehensive studies of Where the sample size and the presence of other risk factors.

#### CONCLUSION

MPV and plateletcrit values were strongly associated with first trimester abortion. These economical and easily measurable platelet indices can be used for prediction of fetal loss. Further randomized, prospective, controlled trials on larger series are necessary for making more precise interpretations.

#### Recommendations

- It is recommended to adopt the MPV, PDW values as a risk factor in cases of abortion.
- Conducting an extensive study to determine the importance of platelet parameters in predicting a abortion in high-risk cases using several successive calibrations of these indicators, and determining a more accurate cut-off value.
- Conducting similar studies to evaluate the usefulness of other laboratory indicators in determining the severity of the projection, in order to reach a high-accuracy indicator

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